GCSE
BIOLOGY
8461/1H

Paper 1 Higher Tier

Mark scheme

June 2021

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives, level of demand and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols/formulae

If a student writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	any **two** from: • (microscope) slide • cover slip • dye / stain • (mounted) needle • pipette / dropper • scalpel • forceps / tweezers	allow named dye / stain ignore water ignore knife allow swab (to collect cells)	2	AO1 4.1.1.5 RPA1
01.2	eyepiece / lens	do **not** accept objective lens	1	AO1 4.1.1.5 RPA1
01.3	to focus (the image / cells)	allow to make the cells / image clear(er) allow to improve resolution (of the image) ignore to move the stage up / down do **not** accept reference to magnification	1	AO1 4.1.1.5 RPA1
01.4	any **one** from: • no cells in the field of view • slide not in the correct position • mirror not in correct position • (objective) lens not clicked into place **or** (objective) lens dirty • (student is) looking at a (large) air bubble • (the microscope is) not focussed	allow light / microscope not switched on / plugged in allow student did not stain the cells allow idea of magnification not being high enough	1	AO3 4.1.1.5 RPA1

01.5	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4–6	AO2
	Level 1: Relevant features are identified and differences noted.	1–3	AO1
	No relevant content	0	
	Indicative Content **Differences:** • red blood cell has no nucleus **or** plant cell has a nucleus • red blood cell has no cell wall **or** plant cell has a cell wall • red blood cell is a biconcave disc **or** there are many different shapes of plant cell • red blood cell contains haemoglobin **or** plant cells do not contain haemoglobin • red blood cells do not contain chlorophyll **or** plant cells (may) contain chlorophyll • red blood cell has no chloroplasts **or** plant cell has chloroplasts • red blood cell has no (permanent) vacuole **or** plant cell has (permanent) vacuole • red blood cells are (much) smaller than plant cells **Similarities:** both have: • cytoplasm • cell membrane • pigments (although they are different) ignore references to mitochondria and ribosomes for **Level 2**, consideration of both red blood cells and plant cells is required.		4.1.1.2 4.2.2.3

01.6	water enters (the cells) by osmosis / diffusion	allow water enters **and** the cell starts to swell ignore explanations of osmosis	1	AO2
	plant cell has a cell wall (which prevents it from bursting)	allow red blood cell has no cell wall (so it swells and bursts)	1	AO1 4.1.3.2 4.1.1.2

Total			**13**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	any **two** from: • sterilise equipment / surfaces (before use) • (use) sterilised agar • secure lid of the Petri dish with (adhesive) tape • only lift lid of Petri dish a little (when setting up plate) **or** lift lid of Petri dish at an angle (when setting up plate)	ignore 'clean' unqualified ignore wash hands allow description of how to sterilise equipment allow description of how to sterilise agar	2	AO1 4.1.1.6 RPA2
02.2	B **and** it kills the fewest bacteria **or** it has the smallest area where no bacteria were growing	 allow it has the smallest clear / white area	1	AO3 4.1.1.6 RPA2

02.3	*(correct measurement)* r = 1.1 (cm) **or** r = 11 (mm) *(recall of the equation)* πr^2 *(calculation/substitution)* 3.14 x 1.1^2 **or** 3.14 x 11^2 = 3.799(4) (from 3.14 x 1.1^2) **or** = 379.9(4) (from 3.14 x 11^2) *correct unit* (3.7994) cm^2 **or** (379.94) mm^2	an incorrect answer for one step does not prevent allocation of marks for subsequent steps ignore calculation and subtraction of filter paper disc area from total area allow d = 2.2 (cm) **or** d = 22 (mm) allow a tolerance of ±1 mm allow correct calculation / substitution using an incorrect measurement allow 3.8 allow 380 do **not** accept unit with no attempt at working / answer	1 1 1 1 1	AO2 4.1.1.6 RPA 2
02.4	any **one** from: • repeat **and** calculate a mean • repeat **and** eliminate anomalies • use a control disc • use different types of bacteria	 allow description of control disc e.g. disc with water / nothing ignore set up a control	1	AO3 4.1.1.6 RPA2
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	normal		1	AO2 4.2.2.5 4.2.2.6
03.2	$92 \div 1.71^2$ 31.46(…) 31.5	 allow correctly calculated value using 92 ÷ 1.71	1 1 1	AO2 4.2.2.5 4.2.2.6
03.3	any **two** from: • the higher the BMI (category) the lower the number of years living in good health • the higher the BMI (category) the higher the number of years living in bad health • the higher the BMI (category), the lower total life expectancy	allow 'more overweight' or 'more obese' for higher BMI category throughout allow the lower the BMI (category) the higher the number of years living in good health allow the lower the BMI (category) the lower the number of years living in bad health allow the lower the BMI (category), the higher total life expectancy if no other marks awarded, allow for **1** mark idea that as BMI increases, quality of life decreases	2	AO2 4.2.2.5 4.2.2.6

03.4	costs the NHS / UK health service / Government / hospitals more money (because need to pay for) additional surgery / medication / hospital stay to treat stroke / diabetes **or** more time off work (if in hospital / unwell) (1) (so) employer / Government have to give financial support (1)	 allow other correct named conditions e.g. heart attack / immobility / disability / arthritis allow more people unable to work allow (so) decreased productivity (in workplace)	1 1	AO3 4.2.2.6
03.5	allow any **one** from: • movement issues • loss of job / income • disability • mental health impact of lack of movement **or** mental health impact of pain • need to visit the doctor / take medication regularly • may need surgery	 allow example of movement issue	1	AO3 4.2.2.6
03.6	<u>type 2</u> diabetes CVD / CHD **or** heart attack / disease **or** stroke	 allow atherosclerosis allow **two** named vascular conditions for **2** marks from heart attack **or** stroke **or** high blood pressure **or** high (blood) cholesterol allow cancer allow liver disease	1 1	AO1 4.2.2.4 4.2.2.6
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	$6O_2 + C_6H_{12}O_6 \rightarrow 6H_2O + 6CO_2$		1	AO1 4.4.2.1
04.2	mitochondria / mitochondrion		1	AO1 4.1.1.2
04.3	any **two** from: • movement / muscle contraction • keeping warm • active transport • building larger molecules	ignore reference to metabolism unqualified allow examples of movement allow examples of building larger molecules e.g. making (named) proteins / cellulose allow cell division ignore growth	2	AO1 4.4.2.1 4.4.2.3
04.4	any **two** from: • anaerobic produces lactic acid **and** aerobic does not • aerobic produces carbon dioxide **and** anaerobic does not • aerobic produces water **and** anaerobic does not • aerobic occurs (mainly) in the mitochondria **and** anaerobic does not • anaerobic releases less energy than aerobic	allow anaerobic creates an oxygen debt **and** aerobic does not allow anaerobic **only** occurs in the cytoplasm allow anaerobic releases less ATP (than anaerobic) do **not** accept anaerobic produces / makes / creates less energy	2	AO1 4.4.2.1
04.5	carbon dioxide ethanol		1 1	AO1 4.4.2.1

04.6	pondweed takes in CO_2 for photosynthesis snail **and** pondweed are respiring producing CO_2	 if no other mark awarded allow rate of respiration = rate of photosynthesis for **1** mark	1 1	AO2 4.4.2.1 4.4.1.1
04.7	(no light so) no photosynthesis **or** plant is not taking in CO_2 **and** snail **and** plant are respiring and so are releasing CO_2		1	AO2 4.4.2.1 4.4.1.1
04.8	snail is being decayed / decomposed / broken down (by) decomposers / bacteria (in pond water / snail) (therefore) respiration (of decomposers / bacteria) releases CO_2	ignore being fed on allow fungi / microbes / microorganisms do **not** accept anaerobic respiration	1 1 1	AO3 AO2 AO3 4.7.2.2 4.4.2.1
Total			**14**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	amino acid(s)	ignore monomers	1	AO1 4.2.2.1
05.2	salivary gland pancreas small intestine	in any order ignore mouth allow duodenum / ileum do **not** accept large intestine ignore intestine unqualified all three correct for **2** marks two correct for **1** mark	2	AO1 4.2.2.1
05.3	starch / substrate binds to <u>active site</u> (of enzyme) (because) shape of <u>active site</u> and substrate are complementary a chemical reaction occurs to produce smaller molecules **or** bonds between the (starch) molecules are broken to produce smaller molecules	ignore starch / substrate fits <u>active site</u> (of enzyme) allow shape of starch / substrate and <u>active site</u> allow them to fit together allow maltose / sugars for smaller molecules	1 1 1	AO1 4.2.2.1
05.4	any **two** from: • time before mixing (starch and amylase) solutions • volume / 5 cm^3 of starch (solution) • volume / 1 cm^3 of amylase (solution) • volume / 1 drop of mixture added to spotting tile • volume / 2 drops of iodine (solution)	ignore time unqualified allow amount as an alternative to volume once only do **not** accept temperature	2	AO2 4.2.2.1 RPA5
05.5	to allow the solutions to reach the same temperature as the water **or** to allow both solutions to reach 5 °C	allow so the solutions can equilibrate with the temperature of the water	1	AO2 4.2.2.1 RPA5

05.6	as temperature increases, (amylase / enzyme) activity increases, to 35 °C after which activity decreases	ignore reference to time	1	AO3 4.2.2.1 RPA5

05.7		allow enzyme for amylase and substrate for starch throughout		AO2 4.2.2.1 RPA5
	(iodine is not yellow-brown because) starch is still present **or** starch has not been broken down		1	
	at 5 °C amylase / starch / molecules have low (kinetic) energy		1	
	(therefore) there are fewer (enzyme-substrate) collisions	allow fewer enzyme-substrate complexes are formed	1	
	at 80 °C the amylase has been denatured	do **not** accept the amylase is killed / has died allow the shape of the amylase / active site changes	1	
	(so) the starch can no longer fit	allow the bonds holding the amylase in its (3D) shape have broken	1	

05.8	keep temperature constant		1	AO3 4.2.2.1 RPA5
	(but) change named factor **and** test a range of values of named factor	named factor e.g. pH **or** enzyme concentration **or** substrate concentration **or** inhibitor concentration	1	

Total			**17**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	A		1	AO2 4.2.3.1
06.2	chloroplast(s)	ignore chlorophyll	1	AO1 4.1.1.3 4.2.3.1
06.3	guard (cells)	ignore stoma(ta)	1	AO1 4.2.3.1 4.2.3.2
06.4	transpiration stream	ignore transpiration unqualified	1	AO1 4.2.3.2
06.5	increased humidity		1	AO2 4.2.3.2

06.6	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4–6	AO1 4.2.3.1 4.2.3.2
	Level 1: Relevant features are identified and differences noted.	1–3	
	No relevant content.	0	
	Indicative content: *Structure* • xylem is made of dead cells **and** phloem is made of living cells • phloem cells have pores in their end walls **and** xylem cells do not have pores in their end walls • xylem is hollow **or** xylem does not contain cytoplasm **and** phloem contains cytoplasm • xylem contains lignin **and** phloem does not (contain lignin) • both made of cells • both tubular *Function* • xylem transports water / mineral ions **and** phloem transports (dissolved) sugars • xylem is involved in transpiration **and** phloem is involved in translocation • xylem transports unidirectionally **and** phloem transports bidirectionally • both transport liquids / substances throughout the stem / leaves / roots / plant For **Level 2**, students must refer to both structure and function of xylem and phloem tissue.		

06.7	*(correct division)* 40 ÷ 7 (in hours) **or** 40 ÷ 420 (in minutes)	allow correct answer from student's readings throughout	1	AO2 4.2.3.2
	5.71 (in hours) **or** 0.0952…(in minutes)	allow correct division from incorrect reading(s) from the tangent	1	
	(correct conversion to minutes) 0.0952…	allow correct conversion at any point in the calculation allow correct conversion of calculated value to minutes	1	
	(answer in standard form) 9.5(238) x 10^{-2}	allow correct conversion of calculated value to standard form	1	
06.8	(less water loss at night)	allow converse if clearly describing 12:00		AO3 4.2.3.2
	stomata are (almost completely) closed		1	
	(because) it's cooler / colder **or** (because) there's less / no light	ignore it's dark at night	1	
Total			**17**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	cells grow / divide abnormally / uncontrollably	ignore mutation	1	AO1 4.2.2.7
07.2	has spread to other parts / organs of the body **or** has spread to the liver / lung **or** has formed a secondary tumour	allow tumour has metastasised	1	AO2 4.2.2.7
07.3	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.		5–6	AO2 4.2.2.3 4.3.1.6 4.4.2.1 4.4.2.2
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.		3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.		1–2	
	No relevant content.		0	
	Indicative content: *Tiredness* • fewer red blood cells • so less haemoglobin • so less oxygen transported around the body • so less (aerobic) respiration can take place • so more anaerobic respiration takes place • less energy released for metabolic processes **or** less energy released so organs cannot function as well • lactic acid produced (during anaerobic respiration) causes muscle fatigue *Frequent infections* • fewer white blood cells / phagocytes / lymphocytes • so fewer antibodies produced **or** less phagocytosis • so fewer pathogens / bacteria / viruses killed *Bleeding* • fewer platelets • so blood does not clot as easily For **Level 3**, reference to all three symptoms must be made.			

07.4	anti-B antibodies in patient / receiver / recipient will bind to type B antigens on person's / donor's red blood cells		1	AO3
	(so) red blood cells clump together and are wider than capillaries **or** (so) red blood cells clump together and block capillaries	allow (so) red blood cells clump together and capillaries burst	1	AO3
	(so) cells have reduced supply of oxygen / glucose **or** (so) cells can't respire	ignore references to energy if no other mark awarded allow antibodies from patient and antigens from donor are matching / complementary shapes for **1** mark	1	AO2 4.2.2.3 4.3.1.6
07.5	no antigens (on type O red blood cells)		1	AO3 4.2.2.3 4.3.1.6
	(so) antibodies cannot bind (to the antigens / red blood cells)	allow no clumping (of red blood cells)	1	
07.6	hepatitis C infection		1	AO3 4.2.2.3 4.3.1.1
07.7	no / less bile reaches the small intestine	ignore less / no bile produced	1	AO3
	(so) less / no emulsification of fat	allow correct description of emulsification do **not** accept reference to chemical digestion	1	AO1
	(so) smaller surface area for lipase to break down fat		1	AO1
	pH of small intestine is not neutralised / alkaline	allow pH of small intestine is acid / low	1	AO2
	(so) lipase is not at its optimum pH to break down fat	pH (of small intestine) is not suitable for lipase to break down fat	1	AO2 4.2.2.1
Total			**19**	